Yamaha CL & QL Series with KLANG In-Ear Monitoring Solutions

Contents

www.yamahaproaudio.com

1.0   Introduction

In-ear monitoring for performers on stage and in a studio is becoming more and more popular, and for good reason. It can provide higher quality sound, it can protect the performer from too much noise, it can clean up the sound on stage so the audience can hear a better mix, and it can provide a consistent mix for the performer even when they move around.

However, high quality equipment and skilled engineers are usually needed to create and operate successful systems. But still, musicians can feel isolated and uncomfortable once they put their ear-phones in, due to the static one dimensional nature of the monitor mix.

This is where KLANG:vier and KLANG:fabrik products can help, to add a 3-dimensional dynamic panorama to the mix. The performers can now hear a life-like 3-D surround mix in their ear-phones, with an option to adjust automatically as they turn around, just as if they were working in an entirely natural acoustic environment. It can be setup and managed easily by the sound engineer, and tweaked by the performers using a wireless tablet or smart phone.

This guide will show how to setup the Yamaha CL / QL mixers, how to connect Dante and the additional network equipment, and how to set the KLANG devices. It's relatively easy to achieve an absolutely outstanding result!

Here are the relevant websites for finding further information about the products:
www.yamahaproaudio.com
www.audinate.com (for information about Dante)
www.klang.com

2.0   Equipment & Cables

Select a Yamaha digital mixing console to suit the needs of the event. There are three sizes of CL-series and two sizes of QL-series to choose from, depending on the needs for channel count and number of faders. Other Yamaha mixers such as RIVAGE PM10, M7CL, LS9, PM5D, DM2000, TF-series could also be used with optional Dante interface cards installed. This guide will focus on the setup for CL & QL consoles, using their color touch-screens and built-in Dante connectivity.

Choose your ideal Dante enabled digital mixer:
QL1 (32 mono in, 24 mix/matrix buses)
QL5 (64 mono in, 24 mix/matrix buses)

CL1 (48 mono in, 32 mix/matrix buses)
CL3 (64 mono in, 32 mix/matrix buses)
CL5 (72 mono in, 32 mix/matrix buses)

Select which in-ear monitoring solutions are best to suit the needs of the event:

KLANG:fabrik provides 8 stereo output mixes in its default mode, with Dante, Optical and analog connections.

KLANG:vier provides 5 stereo output mixes with 4 headphone amps built-in and Dante connections.

KLANG:quelle is a 4-channel Dante enabled headphone amp, which can be used as a solution in its own right, or in combination with KLANG:vier/KLANG:fabrik.

In a typical live sound system there will be several items using Dante audio networking, in which case the use of a network switch would be necessary. There is nothing more suitable than a Yamaha SWP1: chose an 8-port or 16-port version.

All the devices are equipped with Neutrik etherCON connections, so rugged CAT5E or CAT6 cables can be used: make sure the cables are suitable for 1GB Ethernet. For aiding initial system setup, Dante Controller software should be run on a Windows or Mac personal computer.

To control the 3-D in-ear monitor mixes, a wi-fi network needs to be created, so use a suitable wi-fi router that can provide a DHCP service (automatic IP address assignment), along with some tablets and smart phones that run either Android or iOS. The **KLANG**:app is a free-of-charge download. Using an Apple Airport Express, along with iPad and iPhone, will be one of the easier-to-manage solutions.

Use your preferred headphones or wired in-ear phones with KLANG:quelle and KLANG:vier. Or use wireless in-ear monitoring systems with KLANG:vier and KLANG:fabrik.

2.1 System Examples

Various system sizes can be constructed for various monitoring applications, both live and in a recording environment.   Here follows three typical applications.

2.2 Small System with Headphone Amp

In this case, a QL-series mixer is used, providing a Front-of-House mix and sends to the in-ear monitors at the same time. The musicians mix their own monitors using the Yamaha MonitorMix iPhone app. KLANG:quelle is a convenient solution for placing the headphone amp close to the musicians, using Dante audio networking. This could be useful in theatres and houses of worship, where the performers stay in one location. The MonitorMix app works by controlling individual Mix send levels & pans from a QL, CL, or TF-series digital mixing console.

2.3   Medium System with KLANG:vier

With a more demanding group of performers, a dedicated in-ear monitor mixing device becomes useful. KLANG:vier provides four 3-D IEM mixes for the performers, and one additional mix for the sound engineer (or a fifth musician). Use Dante to transmit pre-fader direct outputs and mix buses from the mixing console to KLANG:vier. Attach the wi-fi router to KLANG:vier. So the performers can use KLANG:app to create their 3-D mixes. If a CL-series mixer is used with R-series i/o racks on stage, it is recommended to also use a Yamaha SWP1 network switch.

2.4   Large System with KLANG:fabrik

In larger venues and with a larger group of performers, there will be separate mixing consoles and sound engineers for Front-of-House and Stage Monitors. When there are more mobile performers using in-ear monitoring systems, KLANG:fabrik can dramatically enhance the experience for 8 or more performers. Additional units of KLANG:fabrik, KLANG:vier and KLANG:quelle can be added for further expansion. The monitor console will send direct outputs and some mix buses via Dante to KLANG:fabrik. KLANG:fabrik can be used with redundant Dante networks, for increased reliability. The wireless control of KLANG:fabrik and the CL mixer can share one wi-fi router, though it is best to separate this control from Dante by using VLANS in the switches. (VLANs are virtual local area networks, where different types of data and devices are separated, even though they share the same switches and cables). Yamaha SWP1 network switch provides all the necessary functionality in its factory presets. The outputs of KLANG:fabrik can be sent via analog connections to the wireless IEM systems, or via Dante to additional output units. KLANG:fabrik (and KLANG:vier) can also send a CUE bus back to the monitor console via Dante.

3.0   Constructing the System

When building the audio system for the first time, it is recommended to take it step-by-step. Make sure a small part of the system is working well before adding the next part. In this case, build the CL/QL & R-series system first, and check it is behaving correctly.

3.1   DANTE SETUP of CL/QL Console

Make sure one of the CL/QL consoles has CONSOLE ID #1 and is the Dante PREFERRED MASTER. Unless you need to synchronize to an external source, ensure the WORD CLOCK MASTER is set to "DANTE 48k".

Because an in-ear monitoring system is being constructed, keeping the audio latency low is important. Make sure the monitor console has its latency set to 0.25ms. Then use only one network switch on stage between the R-series i/o racks, the monitor console and the IEM processor.

3.2   Yamaha SWP1 Switch Setup

In the large system example, the control data is kept separate from the Dante audio data. This is the safest way to achieve reliable operation. Use the Yamaha SWP1-16MMF network switch to be sure of having enough connections. Set its front panel DIP switch 2 down (1,3,4 up) then turn on its power, to activate Dante Preset A. Use ports 1,2,3,4,5,6, 13,14 for Dante.

Connect the CL/QL consoles and R-series devices, and check they are all working as expected.

3.3 Dante Controller with KLANG:fabrik

Ports 7,8, 11,12, 15,16 can be used for the control connections: CL/QL console Network port, wi-ri router, KLANG Control port.

However, before connecting all the control ports, the Dante Network setting of KLANG:fabrik needs to be checked. Connect KLANG:fabrik's "DANTE-1" port to the SWP1 switch, and also connect a computer to the switch's DANTE VLAN for running Dante Controller software.

Dante Controller can be download free of charge from https://www.audinate.com/products/software/dante-controller
It provides control and monitoring of Dante networks from Windows and Mac OS computers. Once connected, it will automatically discover all the Dante devices in the network. The initial view should look something like this:
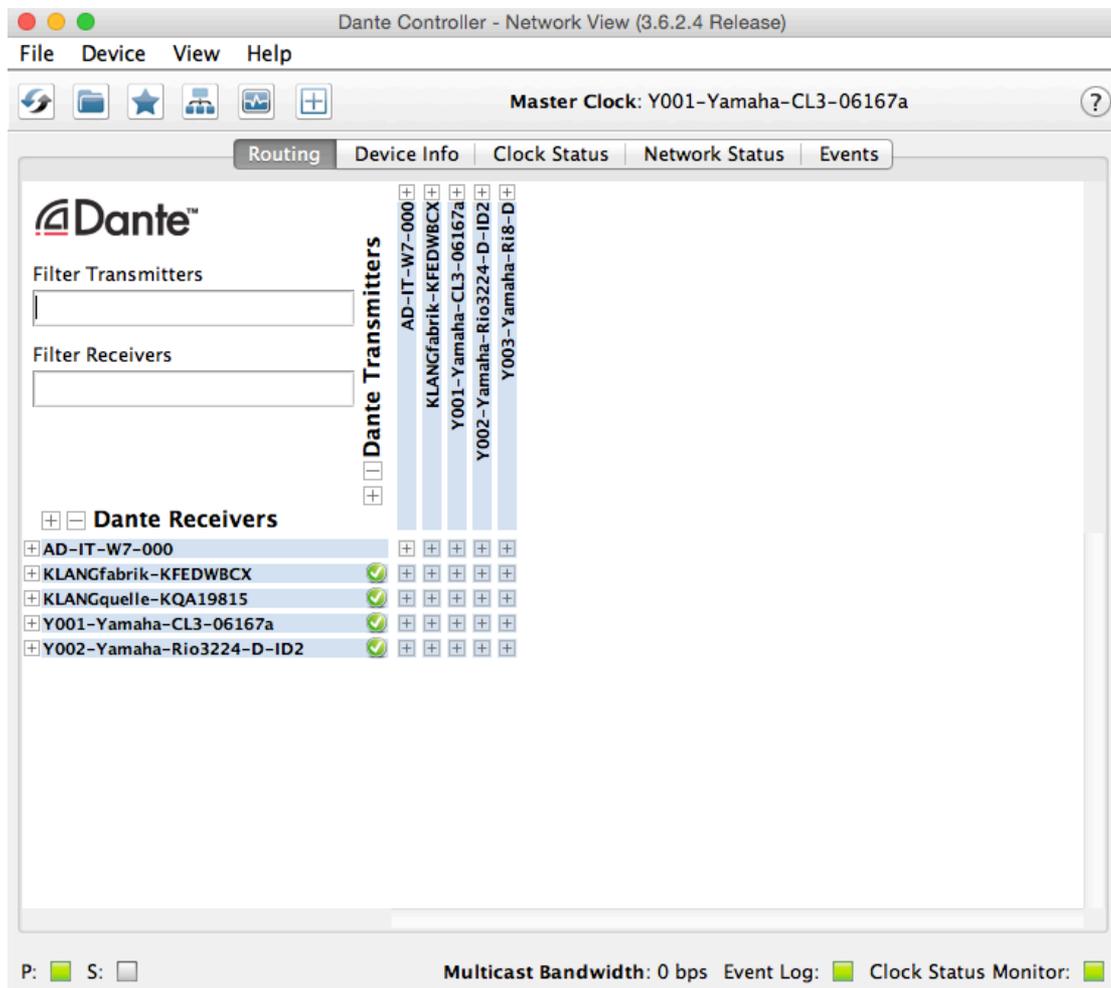
Open the Device menu, and select "Device View". Then select the KLANG:fabrik device from the drop-down menu. Go to the "Network Config" tab, and find the "Switch Configuration" setting. There are four options for this. To suit different types of network. In larger networks, it is best to separate Dante audio and control, so selecting either "Switch detached Control" or "Redundant detached Control" are the preferred options. "Switch detached Control" keeps the KLANG:fabrik Dante

ports in "Daisy-Chain" mode. "Redundant detached Control" allows KLANG:fabrik to join redundant Dante systems.
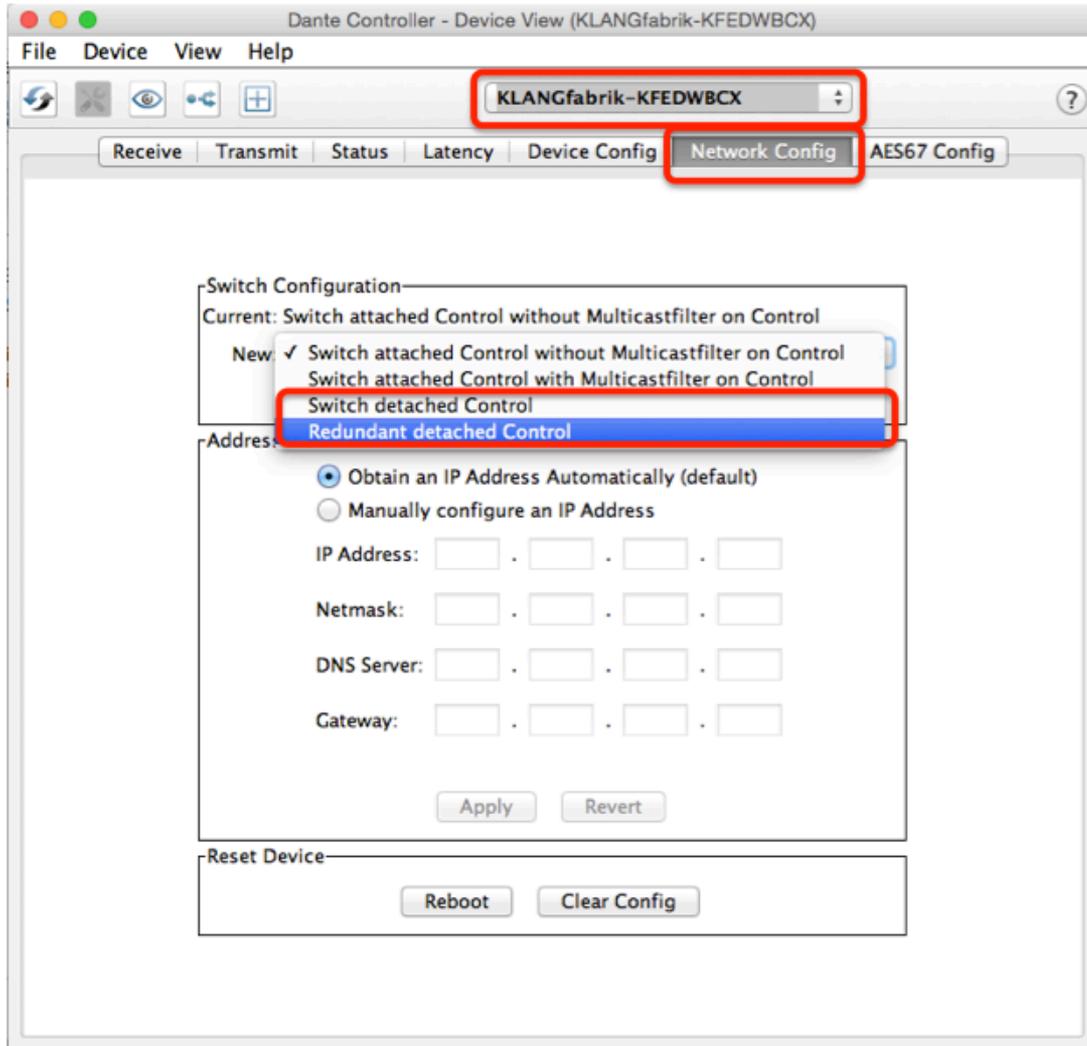
After changing this setting, the device must be rebooted: use the "Reboot" button at the bottom of the view.

3.4 The Control Network

Connect the KLANG:fabrik "CONTROL" port to the SWP1 switch, ensuring a port assigned to VLAN2 is used. Also connect the wi-fi router and the CL/QL console's network control port. (Use SWP1 ports 7,8, 11,12, 15,16).

The wi-fi router should have "DHCP" enabled, so it provides an IP address to all the compatible devices in the same VLAN, and to all the wireless devices connecting to it. An Apple Airport will by default use the "10.0.1.*" range of IP addresses. Because CL/QL consoles and some other devices use static IP addresses, they are not compatible with DHCP. Therefore, it is best to restrict the range of IP addresses offered by the wi-fi router. Below is a view from the Apple AirPort Utility, where the IP range has been restricted to "10.0.1.21 – 10.0.1.120". That will allow 100 devices using DHCP in the network: more than enough!

Next the IP address of the CL/QL console needs to be edited. It must have the same first three sets of numbers: in this case "10.0.1", but with a unique last number outside of the DHCP range (to avoid any duplicate addresses). Select "10.0.1.128" for example.

The "Gateway Address" of the console also needs changing: it should match the IP address of the actual wi-fi router. In this case it is "10.0.1.1".

After this is updated on the console, it should be powered off and on again. Then the whole network setup should be complete, allowing the sound engineer to use just one device (such as an iPad) to wirelessly control both the CL/QL mixer and the KLANG IEM processor!

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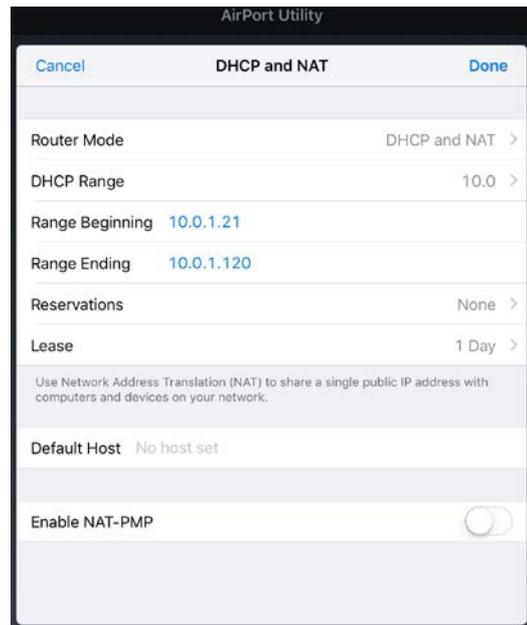
4.0   Audio Routing

The next step is to route audio from the CL/QL mixer to KLANG:fabrik. KLANG:fabrik will take care of audio levels and 3-D panning. The mixer is needed for applying EQ, compression and effects to the audio. So the logical solution is to create a pre-fader Direct Output for all the required channels. However, the default configuration of KLANG:fabrik only allows for 24 inputs, so some sub-groups might need to be created for drum channels, keyboard channels, string instruments, effects returns, and so on. On dedicated monitor consoles, a post-fader direct out might be preferable, so the engineer can use one fader to change the level for all musicians at once.

Use the "APPLY TO ALL INPUT" shortcut to change the Direct Out point for all channels at once.

[Note that the Stereo Input channels do not have a Direct Out function. So to send an Effect Return to KLANG:fabrik, use a pair of mono input channels instead.]

Set the Direct Out Patch to a spare Dante output (the CL1/3/5 and QL5 consoles have 64 Dante outputs available).

It makes sense to use 24 consecutive Dante Outputs to send to KLANG:fabrik. Press the box next to the DIRECT OUT ON button to make the patch to a Dante Output.

If using sub-groups (Mix Buses), their output will always be post-fader, so adjusting the fader on the console will change the level for all the performers using the KLANG system.

4.1 CL/QL Console Dante Output Patch

To patch a Mix Bus to a Dante output, go to the "I/O DEVICE" menu. Press the "DANTE PATCH" tab at the top, and then "OUTPUT PORT SETUP".

This window shows all 64 Dante outputs from the console. Populate 24 of them with Direct Outputs or Mix Buses to send to KLANG:fabrik.

4.2 KLANG:fabrik Dante Inputs

Now the audio must be routed through the Dante network to KLANG:fabrik's inputs. This can be achieved with either Dante Controller software or the CL/QL console's touch-screen. Here follows how to use the console's interface.

Enter the SETUP menu, and the DANTE SETUP menu. Choose the DEVICE MOUNT page, and click on a blank box to mount a new Dante device.
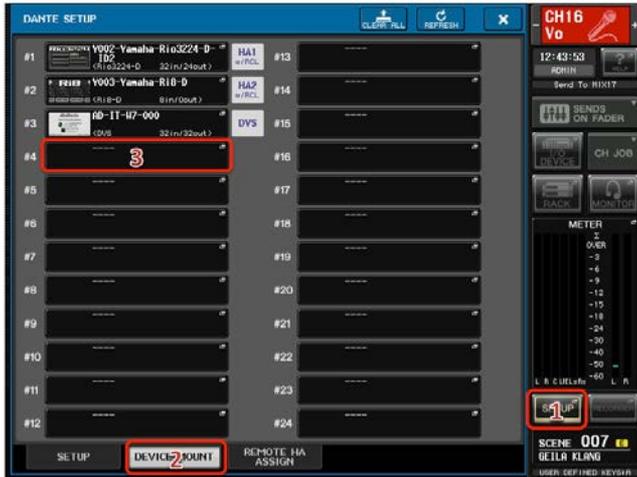
GO TO THE ONLINE DEVICE LIST, SELECT KLANG:fabrik and press OK. Then the device will appear as a mounted device. That will allow patching to be made from the console.
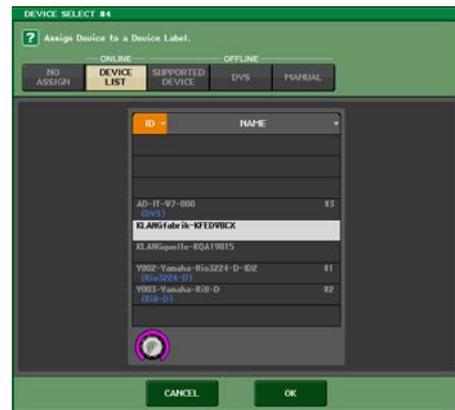
Now open the I/O DEVICE menu again, select the DANTE PATCH tab, and press the KLANG:fabrik device to view its DANTE PATCH (from console output to KLANG input). Populate OUTPUT1 to OUTPUT24 with the console's Dante Outputs that were assigned in section 4.1 above.

Now audio should be reaching the inputs of KLANG:fabrik.

4.3 Outputs to KLANG:quelle

KLANG:quelle has eight Dante inputs, converted to 4 stereo headphone amps. It is a very useful solution for powering wired headphones on stage, in a recording studio or in an orchestra pit. Dante outputs could be sent to it from the CL/QL console or from KLANG:fabrik. Here are instructions for routing Dante audio signals from fabrik to quelle.
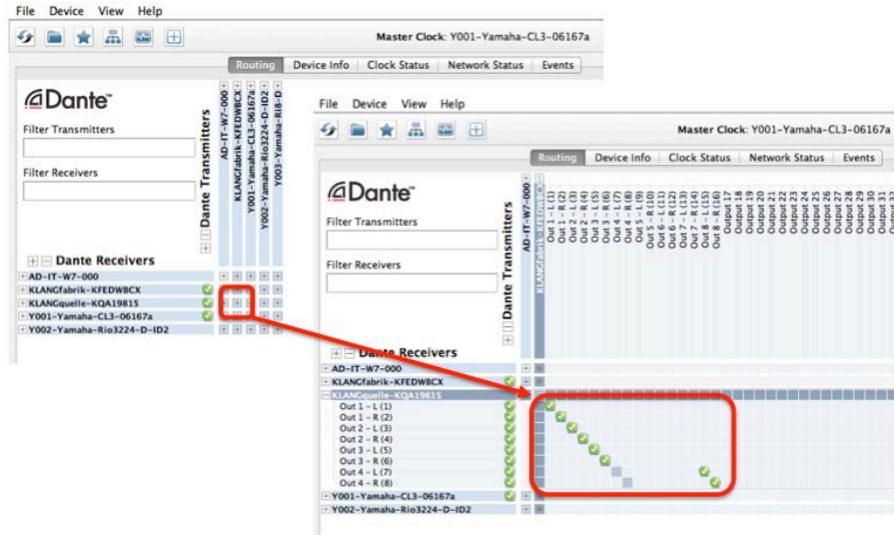
Take a look at the Dante Controller "Routing" page. All the Dante devices are listed in a grid. Click on the cross-point between the KLANG:fabrik transmitter and the KLANG:quelle receiver.

Then all the transmitting channels and receiving channels will be shown. Click on the cross-points to make a route: select which outputs from fabrik will be transmitted to the headphone outputs of quelle.

Don't forget to check the other Dante settings for quelle: open the Device View, and take a look at the "Device Config" tab: check the sample rate is set to "48k" and the latency is set to the minimum value.

(KLANG:quelle can run at higher sample rates such as 96k, making it suitable for use with compatible devices including Yamaha NUAGE and RIVAGE PM10 systems).

5.0   Setup KLANG:fabrik

Now all the necessary audio channels are routed, it is time to setup the KLANG:fabrik 3D In-Ear Monitoring system. KLANG:app is needed for this, which can be downloaded free of charge for Mac OS and Windows from here: http://www.klang.com/en/downloads#klangapp1
It is also available for Android and iOS mobile devices: download from the relevant app store.

5.1   Connect with KLANG:app
Connect the computer or mobile device to the wi-fi network configured in section 3.4. Open KLANG:app, which should automatically discover the KLANG:fabrik (and KLANG:vier) devices in the system. Select the correct device (note the IP address shown is given by the wi-fi router automatically, and should be in the same range as the IP address given to the device running the app).
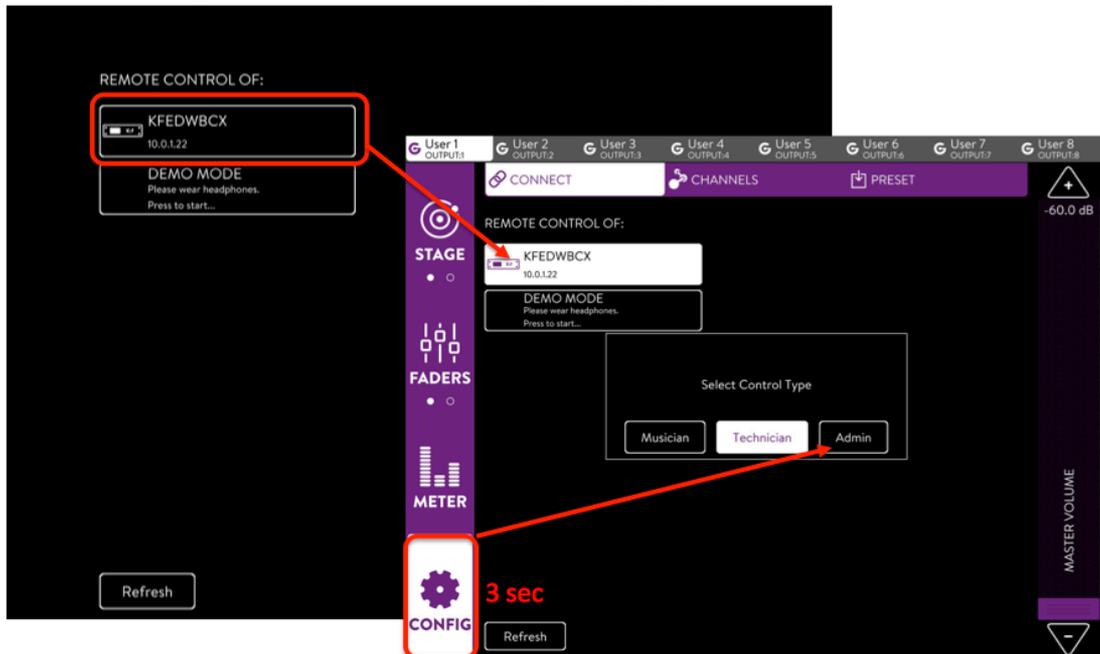
Then press-and-hold "CONFIG" at the bottom-left of the screen for 3 seconds until the "Select Control Type" option is displayed. "Admin" mode is needed to make some important initial settings.

5.2   Admin Mode
In Admin Mode, an extra set of tabs appear near the top of the screen. First select "SYSTEM" and define the number of outputs that are required. 8 is the default: that is, stereo outputs for eight different performers. If the number of outputs is increased, the number of available inputs will decrease as a trade-off.

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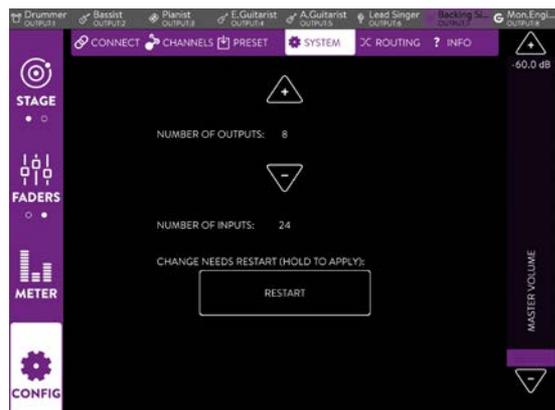
Next, check the "ROUTING" page. Firstly, "Dante" should be selected as the Clock, along the bottom of the screen. Secondly, check that "Dante" is routed to the "DSP", and check that "DSP" is routed to both "Dante" and "DA" (the analog outputs on the rear of the unit). Note that the routing is made in 8-channel blocks, for speed and simplicity.

Now return to the "CONNECT" page, and give a user name and icon to each output channel, to indicate which performers will be listening to the output mixes. If there is a monitor engineer taking care of all the sound on stage, prepare one dedicated output for them.
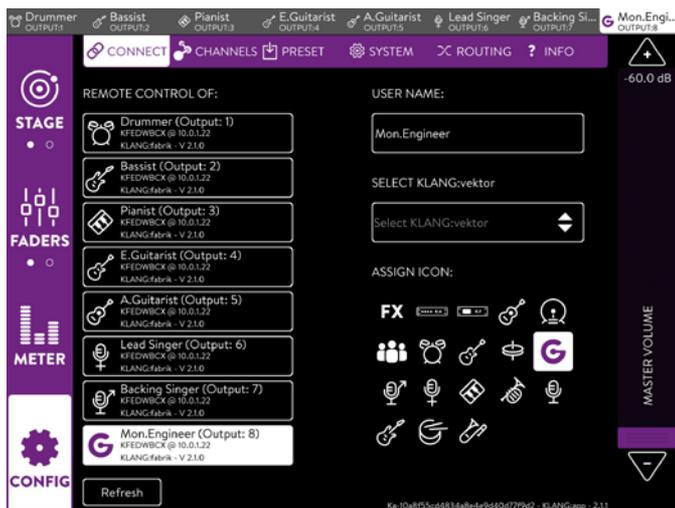
There is one more setting to be made in "Admin" mode, and that is for "KLANG:vektor". This will allow the audio perspective to change as the performer rotates their position on stage. It can be controlled either from a wireless sensor worn by the performer, or from the mobile device that has an accelerometer built-in (such as iPhone or iPad). For a simple setup using an iOS device, select a performer from the left column, and choose "This Device" from the KLANG:vektor menu.

5.3 Channels & Groups

The "CHANNELS" page can be accessed in both "Admin" and "Technician" modes. It is where the inputs are named and arranged into logical groups. Each Group has its own level, solo and mute control.

First select a performer at the top of the screen. Then touch (or click on) a Group or Channel to edit the name, color and icon. Select if the input is mono or stereo. Drag channels up or down to change the order and their Group membership. Once this is completed for one performer (or "user"), it can be copied to the other users with the short-cuts at the bottom of the screen.
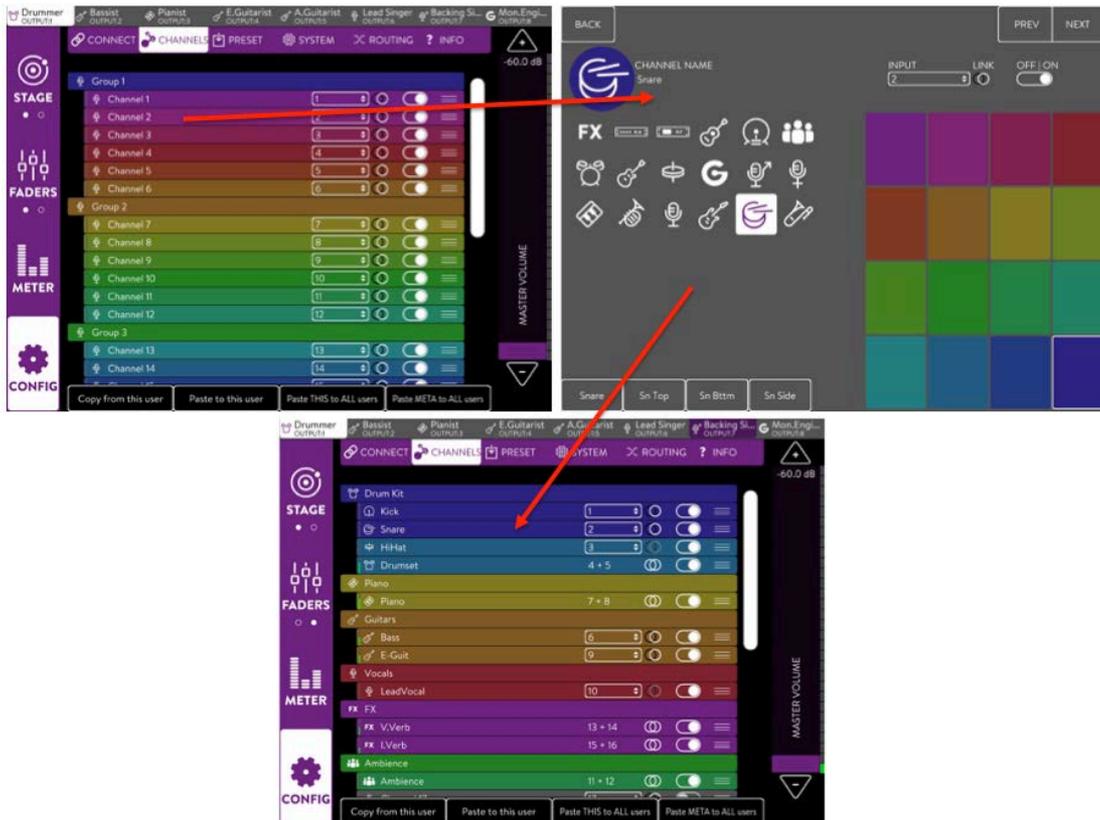
5.4 Meters

Before handing over the pan & level control to the performers, check the level meters for inputs and outputs. This page is only available in "Admin" and "Technician" modes. If the input levels are too high, adjust the Direct Output levels or Mix bus levels on the mixing console. Select the output along the top row of the screen to access their master volume on the right side.
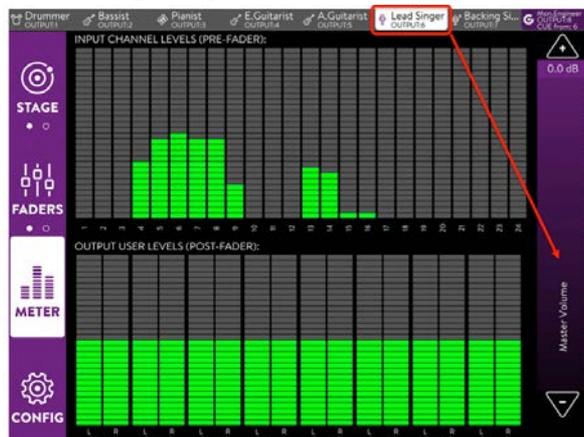
6.0 Mixing with KLANG:app

KLANG:app offers four different panning modes for creating the performers'
monitoring environments:

- Mono
- Stereo
- 3D
- i3D

The mono and stereo choices are easily understood, though it is 3D and i3D panning
where things get very clever. 3D panning allows inputs to be virtually positioned not
just left and right within the performers' ears, but also at wider positions, and front
to back, and even from below to above, within a virtual three-dimensional space.
i3D additionally allows some sound sources to adjust their angle as the performer
rotates their position, like virtual-reality: when turning 90 degrees to face a sound
that was previously originating from the right side, the sound will now be heard in
front.

"Admin" Config mode is needed
to set these panning modes,
which are found at the bottom-
right of the first "STAGE" view.
(Remember, hold "CONFIG" for 3
seconds to change the Config
mode).

6.1 i3D panning

In the first "STAGE" view, when i3D panning mode is set, there are two orbits
surrounding the head of the performer, as well as a straight line from ear to ear.
It is a good idea to position the performers' own sound within the central straight
line: it will not have any ambience or spatial processing applied. Sources placed on
the inner orbit will have a static 3D pan position. Sources placed on the outer orbit
will rotate with the performer in an interactive way, following the movement
detected by KLANG:vektor.

Single sides of a stereo source can
be adjusted by holding the icon of
one side while moving the paired
icon.

Press "STAGE" again at the top-left
corner to see the landscape view.
Drag icons up or down to create a
virtual image of height. This can
simulate the sounds positioned on a
stage with many levels, risers or an
orchestra pit.

6.2   Faders

To adjust the levels of each input source, use the FADERS menu. There are two pages: a simple one for group levels (the groups were set in the CHANNELS CONFIG menu, see section 5.3), and a detailed page for the level, mute and solo of each input source. This is simple enough for most experienced musicians to understand and operate intuitively.
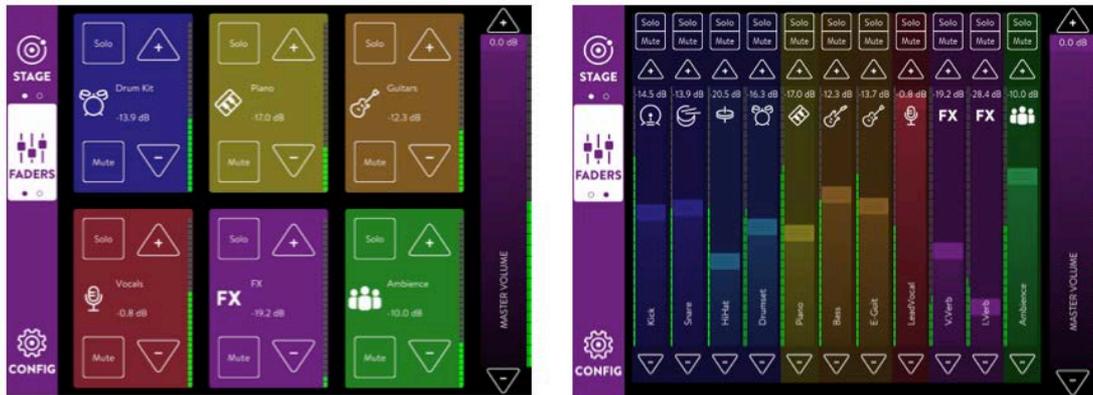
Notice the Master Volume level is always shown on the right side.

7.0   Monitor Engineer CUE Bus

A good monitor engineer will want to be able to hear each performers' mix, exactly as they hear it, and quickly switch between them. This allows them to tune the panning and levels to help the performers who are too busy to make their own adjustments. "Technician" or "Admin" modes are needed for this.

One output mix should already have been setup for the Monitor Engineer. Press and hold their output selection at the top of the screen for about 2 seconds until it turns purple. This output becomes the designated CUE bus. Now, when any other output is selected, its audio is instantly routed via the CUE bus to the Monitor Engineer. The top line of the screen indicates which output is currently cued.

Probably the engineer is working at the mixing console, and will also need to cue input channels and other outputs from the console. There is a convenient solution for integrating the Cue Bus from KLANG:fabrik with the CL/QL mixer's own Cue Bus.

Simply connect the correct analog output of KLANG:fabrik to two OMNI inputs on the rear of the console, such as OMNI 7-8. (on a QL1 or QL5 a different input might be needed: one of the highest-numbered pairs).

Next, open the MONITOR menu and select OMNI 7-8 (or the other input connected above) as the "MONITOR SOURCE SELECT". This means that the input to OMNI 7-8 will be heard in the monitor speakers or headphones whenever no channel on the console is cued.

[If the CL/QL mixer is in 5.1 SURROUND mode, there will be additional monitoring options, including external inputs via Dante. Use Dante Controller to route KLANG:fabrik's CUE output to 2 spare inputs of the CL/QL console. Then in the console's MONITOR menu, set "2CH MONITOR" as the SOURCE SELECT.

In the SURROUND MONITOR SETUP menu, the EXTERNAL STEREO inputs can be configured to route the same Dante inputs to the Monitor bus].

Open the MONITOR menu details to make sure "CUE INTERRUPTION" is enabled, and the MONITOR FADER is at a comfortable level. (The MONITOR FADER can also be assigned to a Custom Fader Layer). Set the MONITOR outputs to a suitable connection for the in-ear headphone amp or wireless transmitter. ONMI 7-8 outputs could be used if an analog connection is required.
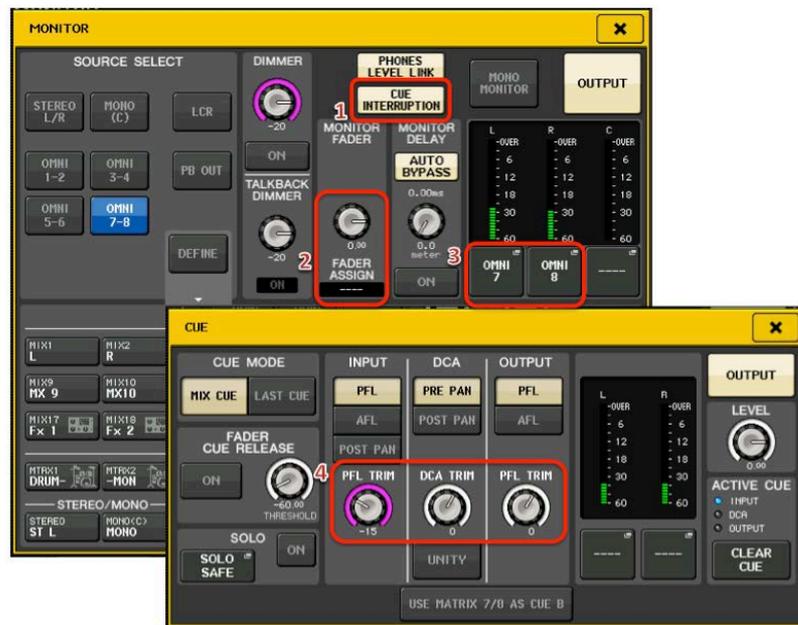
In the CUE menu, adjust the PFL TRIMs to match the listening levels between inputs and outputs.

That's it: enjoy the new dimension of creativity and realism provided to in-ear monitoring by mixing in 3D with KLANG and YAMAHA.

For product manuals and other relevant information, please visit:
www.yamahaproaudio.com
www.klang.com

www.audinate.com
(for information about Dante)